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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/708,932

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Salman Akram

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08/18/2003

TRASK BRITT

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EXAMINER

MACKEY, JAMES P

ART UNIT

PAPER NUMBER

1722

DATE MAILED: 08/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/708,932

Applicant(s)

AKRAM, SALMAN

Examiner

James Mackey

Art Unit

1722

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3,6-20,23-31,34-37 and 39-41 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3,6-20,23-31,34-37 and 39-41 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

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1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 31 July 2003 has been entered.
2. While the Remarks in the Amendment filed on 31 July 2003 state that "claims 8 through 11 have been canceled to eliminate redundancy", no such cancellation has been requested, and in fact these claims have been presented in the amendment as pending claims; clarification is requested. In this Office Action, claims 8-11 have been examined as pending claims.
3. Claims 2, 7, 18 and 26 are objected to because of the following informalities: in claim 2, line 2, "comprises is" should be corrected; in claims 7 and 26, "said nonstick **protective** layer" should be changed to agree with the current name of the layer as recited in the amended independent claims; and in claim 18, line 14, "a nonstick a minimally wettable layer" should be corrected. Appropriate correction is required.
4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.
5. Claims 1-3, 6-20, 23-31, 34-37 and 39-41 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

In claims 1, 18 and 29, the nonstick release layer being a "minimally wettable" layer "for minimizing the wetting of solder paste on the substrate during heating thereof" is new matter unsupported by the original disclosure.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claims 1-3, 6-20, 23-31, 34-37 and 39-41 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 1, 18 and 29, "for forming a first shape of the solder paste ... which substantially conforms to the shape of the solder paste to the cavity" is unclear and indefinite (it appears that the phrase should read --for forming a first shape of the solder paste ... which substantially conforms to the shape of the cavity--).

Further in claims 1, 18 and 29, "minimally wettable" is a relative term of indefinite scope, since the metes and bounds of what is considered to meet the claim limitation "minimally" cannot be ascertained; note that when a term of degree is used in a claim, the specification must provide some standard for measuring that degree, since without proper definitional guidelines, a skilled artisan could not determine the metes and bounds of the claimed invention, *Seattle Box Co. Inc. v. Industrial Crating & Packing, Inc.*, 221 USPQ 568, 574.

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 1-3, 6-11, 16-20, 23-31, 34-37 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ochiai et al. (U.S. Patent 5,643,831; col. 4, lines 50-60 and col. 6, lines 16-17) in view of any one of Yeh et al. (U.S. Patent 5,607,099; Figures 1a and 3; col. 4, line 26), Cordes et al. (U.S. Patent 6,105,852; Figure 3; col. 3, lines 50-52), Tsuji et al. (U.S. Patent 5,930,603; Figure 2; col. 9, lines 30-31), MacKay et al. (U.S. Patent 6,293,456; Figures 3C-3D; col. 13, lines 44 and 51), and Fallon et al. (U.S. Patent 5,872,051; Figures 58-65; col. 40, line 7 through col. 41, line 15).

Ochiai et al. '831 teach the mold apparatus 10 substantially as claimed, comprising a substrate 1 of silicon semi-conductor material and having cavities 12 (in the shape of a rhombus having a width less than a length as clearly shown in Figures 5-7 and 11) formed in the flat planar surface of the substrate, a non-stick silicon oxide or silicon nitride protective/release layer 2 applied to the cavity (the layer provides "low wettability", col. 3, line 25, thus meeting the "minimally wettable" claim recitations), and a paste applicator 18 and inherently a paste dispenser for placing paste on the substrate. Note that the solder paste filled into the cavities 12 of mold 10 completely fills the mold cavities, notwithstanding the disclosure of Ochiai et al. '831 that the molded solder bumps are intended to be heated to reflow the solder to subsequently form solder balls 20; a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations, *Ex parte Masham*, 2 USPQ2d 1647. Also note that Ochiai et al. '831 teach that the mold substrate plate is heated (col. 4, line 66), inherently teaching a heating element (claim 24) to accomplish such a heating function.

Ochiai et al. '831 do not explicitly disclose the shape of the cavity being one of trapezoidal, hemispherical, rectangular and square, do not disclose the cavity depth being "about 28 micrometers" (claims 6, 25, 34), do not disclose the protective/release layer thickness being "from about 200 Angstroms to 5 micrometers" (claims 7, 26, 35), and do not disclose the mold substrate comprising ceramic material (claims 17, 28).

However, with regard to the shape of the cavity, trapezoidal, hemispherical, rectangular and square shaped cavities are conventional in the molding art for mold cavities for producing solder balls, as evidenced by any one of Yeh et al. (square or rectangular shaped cavities as viewed from above, trapezoidal shaped cavities as viewed in cross section, see Figure 1a), Cordes et al. (hemispherical cavities), Tsuji et al. (hemispherical cavities), MacKay et al. (square or trapezoidal shaped cavities as viewed from above, square or rectangular cavities as viewed in cross section), and Fallon et al. (rectangular or trapezoidal shaped cavities as viewed in cross section, square shaped as viewed from above). Therefore, it would have been obvious and well within the level of ordinary skill in the art to have provided the wedge-shaped, rhomboid-mouthed cavity of Ochiai et al. '831 in such conventional mold cavity shapes, since each of the cavity shapes has recognized utility for forming solder balls, and since a skilled artisan would have expected the mold apparatus of Ochiai et al. '831 to perform equally well with the mold cavities having any such conventional mold cavity shapes.

Also, Ochiai et al. '831 explicitly disclose cavity depths of 70 to 100 micrometers (col. 6, line 62), and further disclose the relationship between cavity depth and length of the side of the cavity mouth (col. 6, lines 63-67), including graphically correlating the side length to cavity depths of between 0-100 micrometers (as clearly shown in Figure 13), and Ochiai et al. '831 also

disclose the utility of forming solder bumps having a thickness of "several tens of μm " (col. 2, lines 38-39); therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Ochiai et al. '831 by providing a cavity depth of about 28 μm , since Ochiai et al. '831 recognize the utility of solder bump products of similar thickness, and since Ochiai et al. '831 disclose side lengths of the cavity mouth for a range of cavity depth which clearly overlaps the claimed cavity depth (see Figure 13).

Additionally, Ochiai et al. '831 (Figures 2-3) shows a protective/release layer thickness approximately corresponding to the upper end of the claimed thickness range. Therefore, it would have been obvious to a skilled artisan to have provided the silicon mold substrate with a silicon oxide or silicon nitride protective/release layer by oxidizing or nitriding the silicon mold substrate to a protective/release layer thickness within the claimed range in order to inexpensively produce the protective/release layer and to minimize altering the cavity shape/depth by the protective/release layer.

Furthermore, mold substrates formed of ceramic material are conventional in the molding art for mold substrates for producing solder balls, and therefore it would have been obvious and well within the level of ordinary skill in the art to have provided the mold substrate of Ochiai et al. '831 of a ceramic material, since such is a recognized equivalent to silicon for use as a mold substrate for producing solder balls.

10. Claims 12-15, 39 and 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ochiai et al. '831 in view of any one of Yeh et al., Cordes et al., Tsuji et al., MacKay et al., and Fallon et al., as applied to claims 1-3, 6-11, 16-20, 23-31, 34-37 and 41 above, and further in view of Bolstad (U.S. Patent 2,979,773; col. 2, lines 5-14).

Ochiai et al. '831 disclose the mold apparatus substantially as claimed, as described above, including disclosing that the mold substrate plate is heated (col. 4, line 66), except for disclosing a heater strip or plural heater strips located on another surface of the mold substrate.

Bolstad discloses heater strips for efficiently providing heat to a semiconductor mold material

22. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Ochiai et al. '831 by providing heater strips on the exterior of the mold substrate, as suggested by Bolstad, in order to efficiently provide heat to the mold substrate plate as desired by Ochiai et al. '831.

11. Applicant's arguments filed 31 July 2003 have been fully considered but they are not persuasive.

Applicant argues that it would not have been obvious to modify the **method of making** the mold apparatus of Ochiai et al. '831 to form mold cavities having the claimed shapes; however, the instant claims are directed to a mold apparatus and NOT to a mold-forming process. Moreover, the test for obviousness is not whether the features of one reference may be bodily incorporated into the other to produce the claimed subject matter but simply what the combination of references makes obvious to one of ordinary skill in the pertinent art, *In re Bozek*, 163 USPQ 545; proper inquiry should not be limited to the specific structure shown by the references, but should be into the concepts fairly contained therein, and the overriding question to be determined is whether those concepts would suggest to one skilled in the art the modifications called for by the claims, *In re Van Beckum et al.*, 169 USPQ 47. The examiner contends that a skilled artisan with knowledge of the state of the art would have been motivated to modify Ochiai et al. '831 by providing the mold apparatus with mold cavities of well known

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and conventional shapes, with the expectation that the mold apparatus would function equally well with any such conventional mold cavity shapes, and since such mold cavity shapes have recognized utility for forming solder balls.

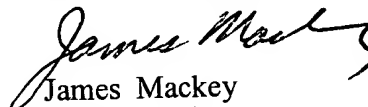
12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Brouillette et al. (U.S. Patent 6,056,191 ; col. 8, lines 32-46) disclose a mold for forming solder balls, wherein the mold cavities may have a wide range of aspect ratios. Farnworth (U.S. Patent 6,523,736; Figures 2-3) discloses a mold for forming solder balls, wherein the mold cavities may have various shapes.

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to James Mackey whose telephone number is 703-308-1195. The examiner can normally be reached on M-F, 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wanda Walker can be reached on 703-308-0457. The fax phone number for the organization where this application or proceeding is assigned is 703-892-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.


James Mackey
Primary Examiner
Art Unit 1722
8/8/03

jpm
August 8, 2003